

## CLAIMS

- 1 1. An add-filter device comprising:
  - 2 a plurality of ring resonators that are arranged to receive an optical signal of a
  - 3 specific wavelength; and
  - 4 at least one Mach-Zehnder Interferometer (MZI) structure that is embedded in
  - 5 said plurality of ring resonators, said at least one MZI structure and ring resonators
  - 6 providing modulation and filtering so that said optical signal can be added to a bus line
  - 7 without affecting the channels contained in said bus line.
- 1 2. The add-filter device of claim 1, wherein said ring resonators comprise heater
- 2 elements.
- 1 3. The add-filter device of claim 1, wherein said at least one MZI structure comprises
- 2 heater elements.
- 1 4. The add-filter device of claim 1, wherein said at least one MZI structure comprises
- 2 unequal arm lengths.
- 1 5. The add-filter device of claim 1 further comprising a drop port.
- 1 6. The add-filter device of claim 1 further comprising a throughput port.
- 1 7. The add-filter device of claim 1, wherein said at least one MZI structure comprises
- 2 more than one MIZ structure having different materials.
- 1 8. The add-filter device of claim 1, wherein said at least one MZI structure comprises
- 2 more than one MIZ structure having different dimensions.

1   9. The add-filter device of claim 1, wherein said at least one MZI structure is be  
2   controlled via the electro-optic effect.

1   10. A method of performing add-filtering and modulation operations on an optical signal  
2   in a single device, comprising:

3                 providing a plurality of ring resonators that are arranged to receive an optical  
4   signal of a specific wavelength to be added onto a bus line that includes a plurality of  
5   signals at different wavelength; and

6                 providing at least one Mach-Zehnder Interferometer (MZI) structure that is  
7   embedded in said plurality of ring resonators, said at least one MZI structure and ring  
8   resonators providing modulation and filtering so that said optical signal can be added to  
9   the bus line without affecting the channels contained in said bus line.

1   11. The method of claim 10, wherein said ring resonators comprise heater elements.

1   12. The method of claim 10, wherein said at least one MZI structure comprises heater  
2   elements.

1   13. The method of claim 10, wherein said at least one MZI structure comprises unequal  
2   arm lengths.

1   14. The method of claim 10 further comprising a drop port.

1   15. The method of claim 10 further comprising a throughput port.

1   16. The method of claim 10, wherein said at least one MZI structure comprises more  
2   than one MIZ structure having different materials.

1 17. The method of claim 10, wherein said at least one MZI structure comprises more  
2 than one MIZ structure having different dimensions.

1 18. The method of claim 10, wherein said at least one MZI structure is controlled via the  
2 electro-optic effect.

1 19. A system for performing add-filtering and modulation comprising:  
2 a plurality of ring resonators that are arranged to receive an optical signal of a  
3 specific wavelength to be added onto a bus line that is arranged to receive a plurality of  
4 signals at different wavelengths; and  
5 at least one Mach-Zehnder Interferometer (MZI) structure that is embedded in  
6 said plurality of ring resonators, said at least one MZI structure and ring resonators  
7 providing modulation and filtering so that said optical signal can be added to said bus line  
8 without affecting the channels contained in said bus line.

1 20. The system of claim 19, wherein said ring resonators comprise heater elements.

1 21. The system of claim 19, wherein said at least one MZI structure comprises heater  
2 elements.

1 22. The system of claim 19, wherein said at least one MZI structure comprises unequal  
2 arm lengths.

1 23. The system of claim 19 further comprising a drop port.

1 24. The system of claim 19 further comprising a throughput port.

1 25. The system of claim 19, wherein said at least one MZI structure comprises more than  
2 one MIZ structure having different materials.

1 26. The system of claim 19, wherein said at least one MZI structure comprises more than  
2 one MIZ structure having different dimensions.

1 27. The system of claim 19, wherein said at least one MZI structure is controlled via the  
2 electro-optic effect.